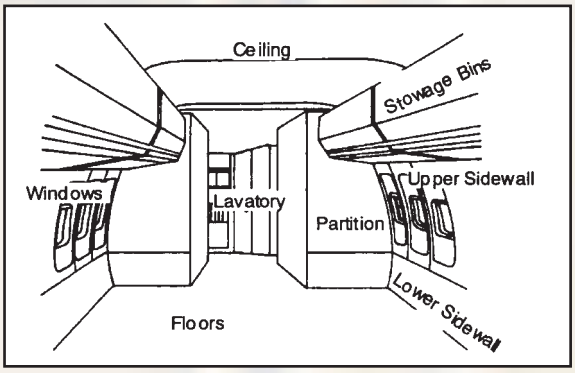
FAA William J. Hughes Technical Center

Fire Research Program

Forty percent of the passengers who survive the impact of an aircraft accident subsequently die in a postcrash fire.

Unless this percentage is reduced or the accident rate decreases, the number of fire fatalities will increase by 4 percent each year with the expected growth in passenger air traffic. Compounding the upward trend in aircraft fire fatalities is the additional fire load associated with the 1 percent annual growth in the use of lightweight, combustible polymers and composites for aircraft interiors and structures. Current aircraft contain several tons of combustible plastics as cabin interior components–a fire load comparable to the equivalent weight of aviation fuel. The cabin fire load will approximately double in the very large (800 passenger) airplanes under development by airframe manufacturers unless ultra fire-resistant materials become available.

The use of materials with improved fire resistance (relative to commodity plastics) was mandated by the FAA in 1987 with requirements for the burning rate and flame spread of seat cushions and in 1990 with the establishment of regulations limiting the heat release rate of large area cabin interior components. These regulations provide an additional 2-4 minutes of cabin escape time in the event of an aircraft accident involving a postcrash fuel fire outside the cabin. Further improvement in cabin material fire safety is unlikely without government-sponsored research because the market is limited to passenger aircraft cabins and does not justify the research investment by private industry. In response to this situation the FAA initiated a proactive, long-range research effort in fire-resistant materials to identify and develop the enabling materials

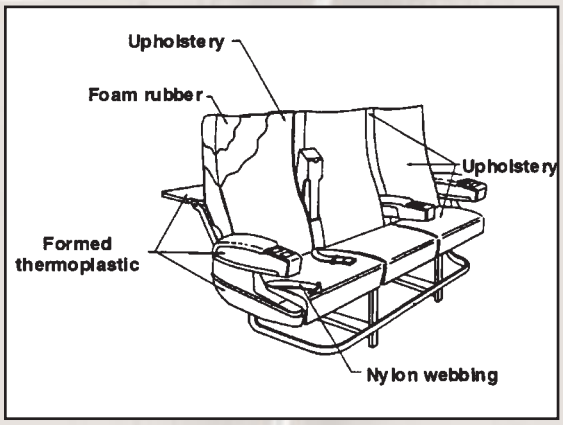


technology for a cost-effective, fireproof passenger aircraft cabin. The drawing above shows some of the currently flammable components in the aircraft cabin that could be replaced by the ultra fire-resistant materials that will be developed in this research program. In combination with other fire safety system improvements, ultra fire-resistant materials will eliminate catastrophic in-flight fuselage fires and provide a minimum of 10 minutes of passenger escape time in a postcrash fire.

The objective of the Fire-Resistant Materials program is to eliminate burning cabin materials as a cause of death in aircraft accidents. Research is basic in nature and focuses on the synthesis, modeling, processing, and characterization of new materials and materials combinations. In accord with the recommendations of the National Research Council's Materials Advisory Board in their report "Fire- and Smoke-Resistant Interior Materials for Commercial Transport Aircraft," (NMAB-477-1, National Academy Press, 1995) near-term technical approaches include modification of specialty and commodity polymers using additives and processing routes. Databasing of material fire performance in micro-, bench-, and full-scale testing supports science-based studies of polymer combustion and identifies critical fire performance properties to guide development. Long-term activities include

Safety

the synthesis of new, thermally stable, low fuel value organic/inorganic polymer systems. The synthesis effort is supported by fundamental research to understand polymer combustion and fire resistance mechanisms using numerical and analytic modeling and the development of new characterization techniques.



The output of this research will be an order-of-magnitude reduction in cabin fire hazards relative to current cabin materials at comparable cost and functionality. Since the heat release rate of burning materials is the primary fire hazard indicator, the technical objective is to develop low-cost, lightweight, serviceable polymers and composite materials with zero heat release rate as measured by FAR 25.853(a-1), "Heat Release Rate Test for Cabin Materials." Materials with a zero heat release rate will provide sufficient passenger escape time in a postcrash fuel fire to ensure survivability. With respect to the 1996 baseline for new aircraft, individual fire-resistant materials will demonstrate a 50% reduction in heat release rate by the year 2002. Prototype cabin components fabricated from combinations of fire-resistant materials will demonstrate zero heat release rate by the year 2010. The potentially higher initial cost of fire-resistant cabin materials will be offset by user financial incentives which include shorter process cycles, better durability, and lower heat release rate. The drawing on the left shows some of the flammable seat components that are candidates for new fire-resistant materials.

The fire-resistant materials program is executed from an in-house technology base at the William J. Hughes Technical Center, Atlantic City International Airport, New Jersey, through FAA-industry partnerships and university-based research consortia. Direct funding by several Fortune 100 aircraft and chemical companies to FAA-university-industry consortia covers about 30% of research costs for fire safe materials. During the first 2 years of the program (1995-1996) significant progress has been made in reaching our interim goal of a 50% reduction in the heat release rate of cabin materials by 2002 and zero heat release rate cabin materials by 2010.

To find out more about the Fire Research Program, contact:

Airport and Aircraft Safety Research
and Development Division
Aircraft Safety Research
and Development Branch
Fire Safety Section, AAR-422

Federal Aviation Administration
William J. Hughes Technical Center
Atlantic City International Airport, NJ 08405
Phone: (609) 485-6076
Fax: (609) 485-5785